

Spin Tune in the Single Resonance Model With Pairs of Snakes

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The chief features of spin motion in at proton storage rings near resonance between spin motion and vertical betatron motion are, for well separated resonances, conveniently modeled with the rotating wave approximation whereby just one Fourier harmonic in the perturbation to the spin motion is considered. This is the “single resonance model”. If pairs of Siberian Snakes are then included to restrict the closed orbit spin tune to $1/2$, theory and simulations show that so called “snake resonances” occur during acceleration at certain rational vertical orbital tunes.

However, to discuss spin-orbit resonance one needs the amplitude dependent spin tune $\nu(J_y)$ where J_y is the vertical amplitude. There are indications from a number of sources, that for irrational vertical tunes, the amplitude dependent spin tune is always exactly $1/2$ independently of J_y . But it is well known on general theoretical grounds, and confirmed numerically, that for rational tunes the amplitude dependent spin tune may not exist. We discuss the classification of snake resonances and the calculation of the spin tune in this model. In particular we present the analytical form that the model takes in the SODOM formalism [1,2].

References

- [1] K. Yokoya, DESY Report 99-006 (1999) and Los Alamos archive: physics/9902068.
- [2] G.H. Ho-staetter, M. Vogt and D.P. Barber, Phys. Rev. ST Accel. Beams 11(2) 114001 (1999).